Cruise Report
U.S. Geological Survey Research Cruise 2017-674-FA
Santa Barbara Littoral Cell, California
September 5-9, 2017

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USGS

Summary

From September 5 through 9, 2017, the Pacific Coastal and Marine Science Center of the U.S Geological Survey (USGS) conducted single-beam bathymetric surveys in the nearshore waters of the Santa Barbara Littoral Cell (Figure 1). The work was conducted using two Coastal Profiling Systems (CPS) (personal watercraft outfitted with custom GPS and echosounder survey equipment). Watercraft were launched out of Santa Barbara, Ventura and Channel Islands Harbors. The survey was the eighteenth in a series of surveys in this area, starting in October 2005.

The shoreline of the Santa Barbara Littoral cell consists of a diverse assemblage of sandy, rocky and armored segments with a variety of exposures to waves and currents due to differing degrees of sheltering by offshore islands and nearshore reefs. There are two major river systems (Ventura and Santa Clara) that provide highly variable inputs of terrestrial sediment into the littoral cell. The Santa Clara River is particularly noteworthy as it is the largest source of sediment to southern California nearshore waters. Alongshore transport is driven by wave activity and primarily is from NW to SE, with nearshore sediments ultimately feeding into Mugu Canyon at the southern end of the littoral cell. There is significant development along much of the coastline. Surveys in this region are designed to document coastal evolution on a variety of timescales, from large surf and flood events, to seasonal and decadal, to improve our understanding of the coastal processes that affect shoreline erosion and accretion. Data from these surveys are being used in models of coastal change, including future conditions that include sea level rise and climate change, and to support management of existing coastal resources.

It was determined that the operating frequency of the sonar system (200 kHz) is above the cutoff hearing threshold for marine mammals, therefore the CSLC determined that the observance of a safety zone is not a requirement for this survey (personal communications, K. Keen, CSLC), and that a marine wildlife monitor (MWO) was not required due to operational limitations of the personal watercraft used.

USGS research cruise 2017-674-FA took place over 5 consecutive days from September 5-9, 2017. Most of the Ventura area was surveyed on 9/5, with the southern portion of Rincon surveyed on 9/6. Carpinteria and the northern portion of Rincon were surveyed on 9/7, with Goleta surveyed on 9/8 and Mugu on 9/9. All operations, including transits and surveying, took place during daylight hours (0800 – 1500). Mapping was completed using hull-mounted 200-kHz , Odom 9 degree downward conical beam transducers and Odom Echotrac CV100 echo

sounders at survey speeds of ~4 knots. Weather observations are provided in Appendix A and marine wildlife observations in Appendix B. As-surveyed track lines are shown in Figures 2-6, with start and end locations listed in Tables 1-10.

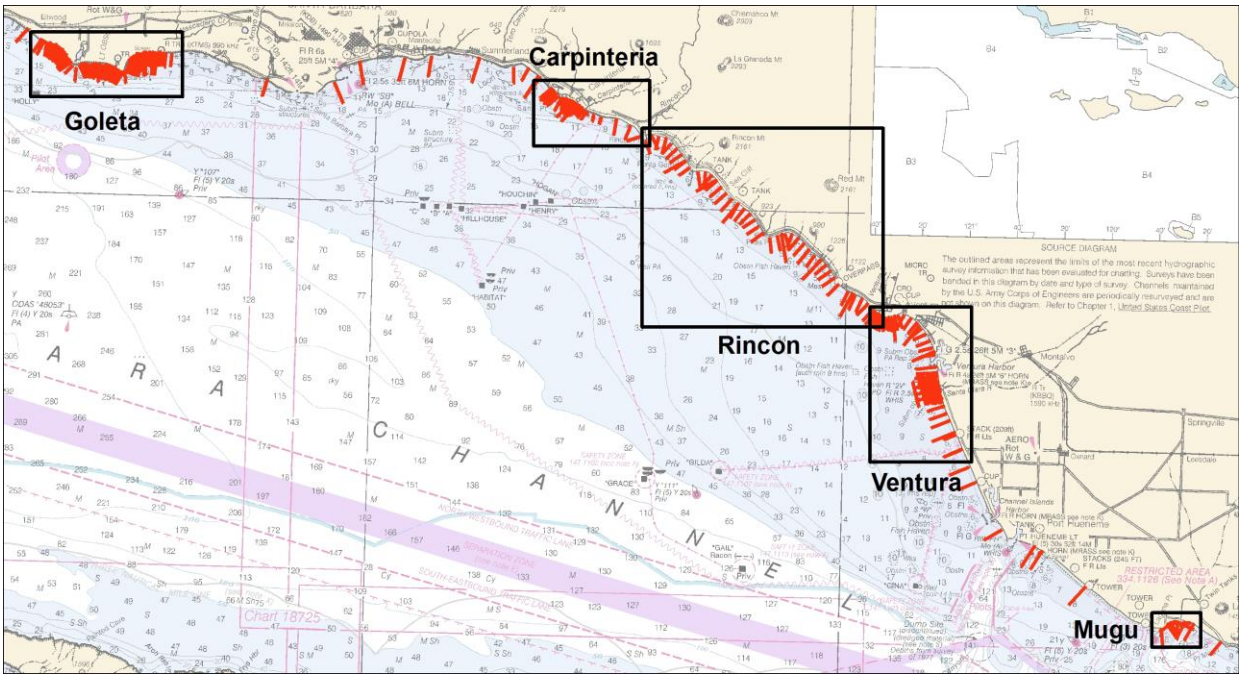

Figure 1. Overview of Santa Barbara Littoral Cell study area and planned survey lines in five focus areas. Longer lines in and between focus areas are BEACON lines, which are surveyed in the Fall in odd years.

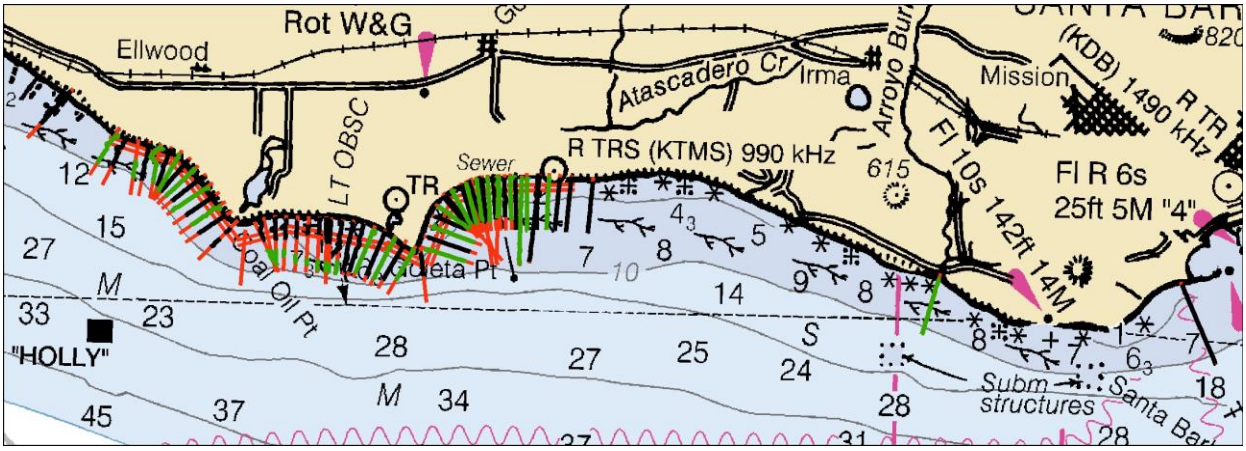

Figure 2. As-surveyed lines, Goleta area. Target lines are in red, surveyed lines are in black for black PWC, green for green PWC.

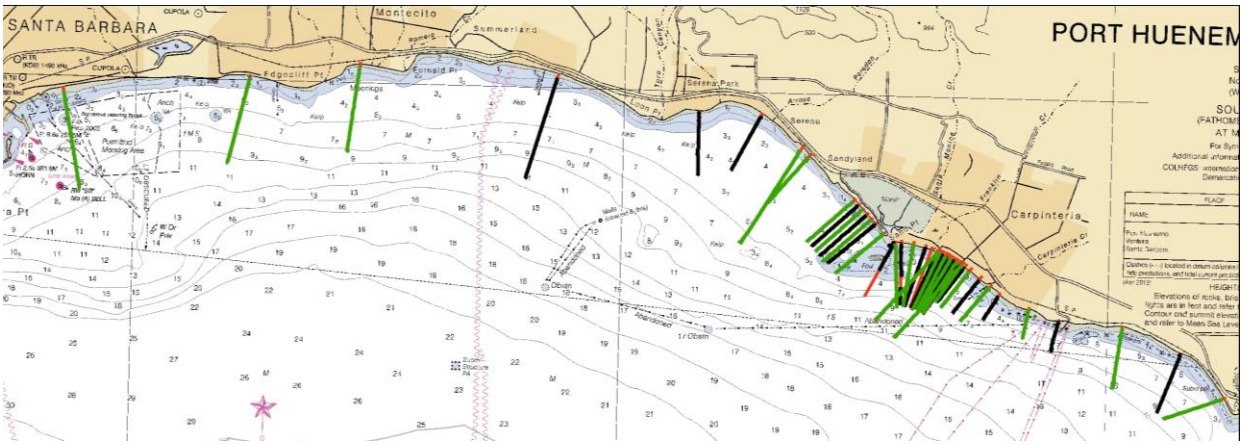

Figure 3. As-surveyed lines, Carpinteria area. Target lines are in red, surveyed lines are in black for black PWC, green for green PWC.

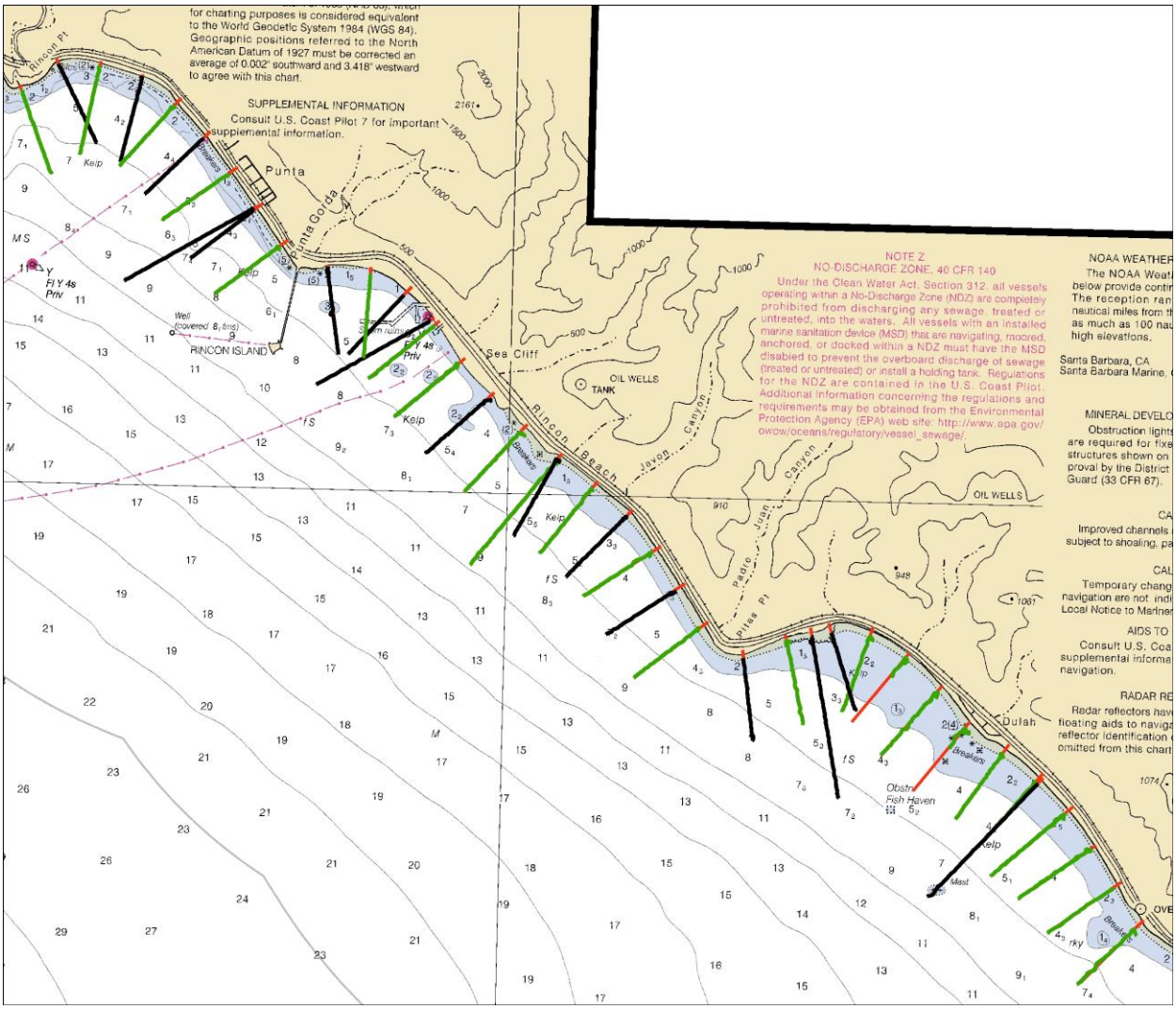

Figure 4. As-surveyed lines, Rincon area. Target lines are in red, surveyed lines are in black for black PWC, green for green PWC.

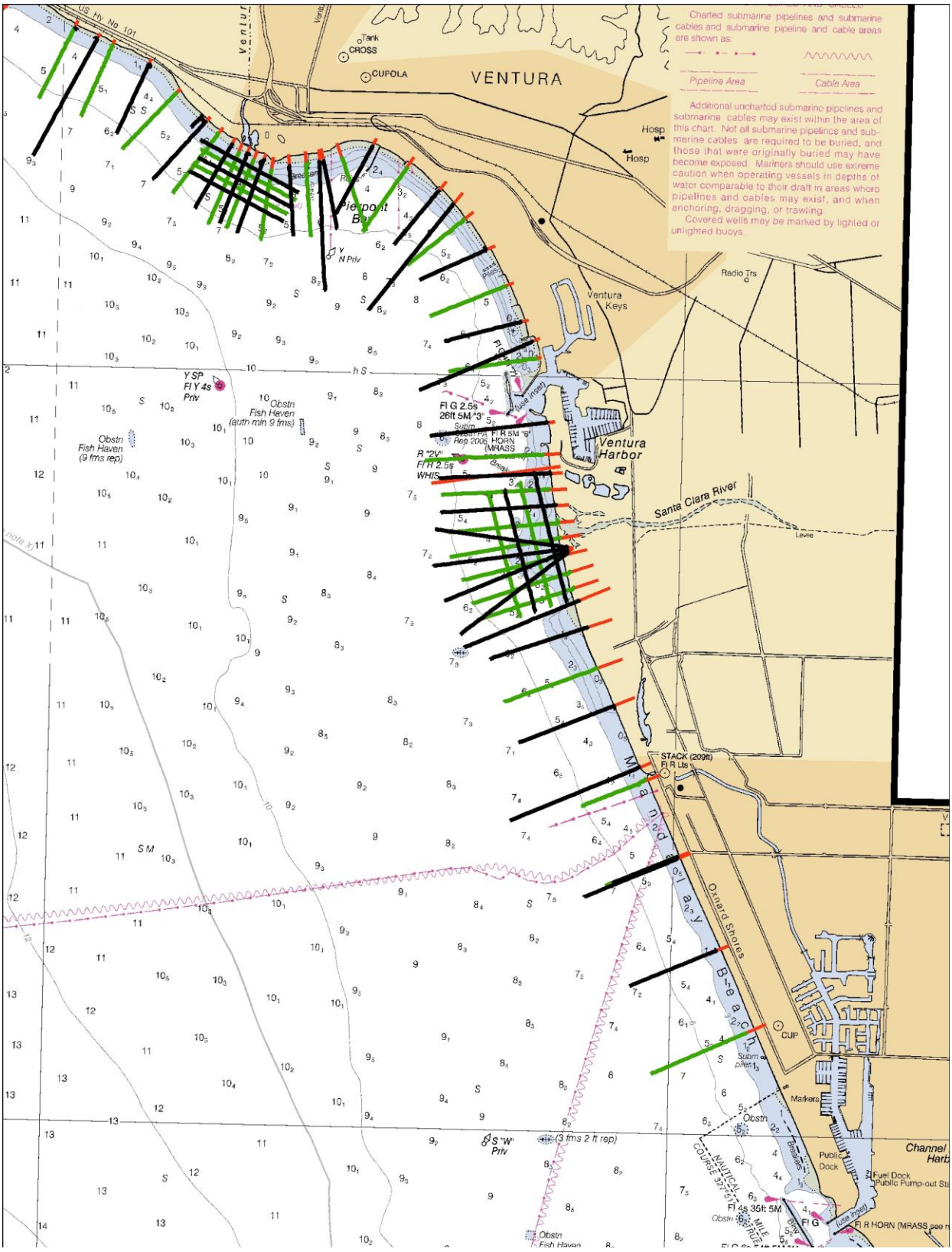

Figure 5. As-surveyed lines, Ventura area. Target lines are in red, surveyed lines are in black for black PWC, green for green PWC.

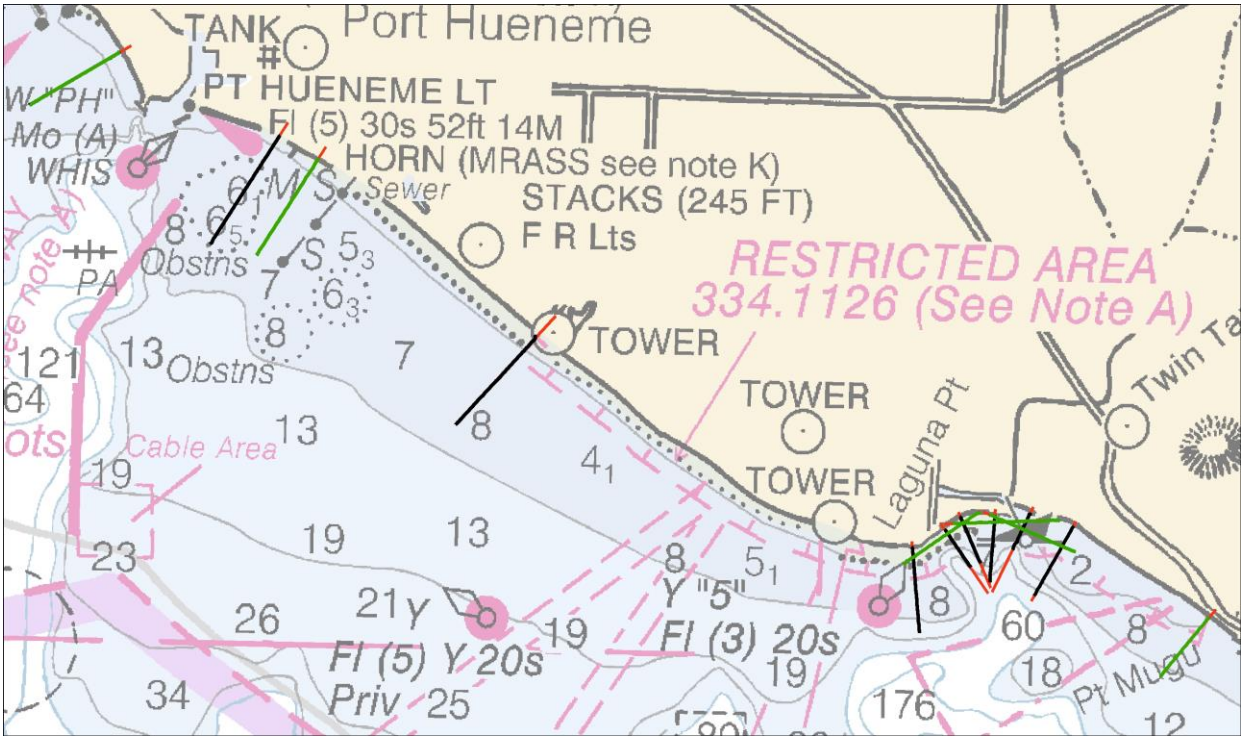

Figure 6. As-surveyed lines, Mugu area. Target lines are in red, surveyed lines are in black for black PWC, green for green PWC.

Table 1. As-surveyed line endpoints, Goleta, Black PWC

	Start			End		
Line	Date/time (PST)	Lat	Lon	Date/time (PST)	Lat	Lon
050_0906.RAW	9/8/2017 9:06	34.389923	-119.689822	9/8/2017 9:14	34.402198	-119.696512
000_0932.RAW	9/8/2017 9:32	34.408081	-119.812012	9/8/2017 9:36	34.416221	-119.811162
001_0938.RAW	9/8/2017 9:38	34.416629	-119.815066	9/8/2017 9:43	34.408138	-119.816168
002_0945.RAW	9/8/2017 9:45	34.408378	-119.81836	9/8/2017 9:50	34.41686	-119.817605
004_0951.RAW	9/8/2017 9:51	34.417001	-119.821909	9/8/2017 9:58	34.408354	-119.821829
074_1000.RAW	9/8/2017 10:00	34.403201	-119.823048	9/8/2017 10:08	34.417103	-119.821513
006_1011.RAW	9/8/2017 10:11	34.417121	-119.82647	9/8/2017 10:16	34.408247	-119.825844
008_1021.RAW	9/8/2017 10:21	34.410195	-119.828045	9/8/2017 10:25	34.416543	-119.82839
010_1026.RAW	9/8/2017 10:26	34.416736	-119.830259	9/8/2017 10:30	34.409868	-119.829865
012_1031.RAW	9/8/2017 10:31	34.409396	-119.831661	9/8/2017 10:35	34.41646	-119.832699
077_1036.RAW	9/8/2017 10:36	34.416363	-119.833054	9/8/2017 10:41	34.409577	-119.831744
078_1041.RAW	9/8/2017 10:41	34.409602	-119.83242	9/8/2017 10:45	34.415843	-119.835244
016_1047.RAW	9/8/2017 10:47	34.415048	-119.836357	9/8/2017 10:51	34.409117	-119.834065
018_1059.RAW	9/8/2017 10:59	34.408637	-119.835113	9/8/2017 11:03	34.413262	-119.840042
079_1104.RAW	9/8/2017 11:04	34.413492	-119.839715	9/8/2017 11:08	34.40894	-119.834678
020_1110.RAW	9/8/2017 11:10	34.408191	-119.835423	9/8/2017 11:13	34.41006	-119.841551
022_1115.RAW	9/8/2017 11:15	34.406593	-119.842945	9/8/2017 11:20	34.404606	-119.834701
024_1122.RAW	9/8/2017 11:22	34.404087	-119.844212	9/8/2017 11:25	34.400427	-119.843453
026_1127.RAW	9/8/2017 11:27	34.399798	-119.851295	9/8/2017 11:31	34.405445	-119.84745
028_1133.RAW	9/8/2017 11:33	34.407009	-119.851073	9/8/2017 11:38	34.40037	-119.85455
030_1139.RAW	9/8/2017 11:39	34.400846	-119.857905	9/8/2017 11:44	34.408529	-119.855253
032_1146.RAW	9/8/2017 11:46	34.408791	-119.859398	9/8/2017 11:51	34.403888	-119.861202
031_1156.RAW	9/8/2017 11:56	34.40099	-119.858994	9/8/2017 12:02	34.408717	-119.857352
033_1204.RAW	9/8/2017 12:04	34.409114	-119.861622	9/8/2017 12:06	34.405343	-119.861966
080_1208.RAW	9/8/2017 12:08	34.405475	-119.862583	9/8/2017 12:10	34.409203	-119.862568
034_1211.RAW	9/8/2017 12:11	34.408976	-119.863762	9/8/2017 12:13	34.406557	-119.863922
035_1214.RAW	9/8/2017 12:14	34.406517	-119.866075	9/8/2017 12:14	34.406921	-119.866307
035_1215.RAW	9/8/2017 12:15	34.406538	-119.866068	9/8/2017 12:16	34.408199	-119.866095
036_1219.RAW	9/8/2017 12:19	34.408646	-119.868168	9/8/2017 12:20	34.405997	-119.868371
037_1221.RAW	9/8/2017 12:21	34.405619	-119.870349	9/8/2017 12:23	34.407603	-119.870474
037_1223.RAW	9/8/2017 12:23	34.407358	-119.870964	9/8/2017 12:25	34.40897	-119.870457
038_1225.RAW	9/8/2017 12:25	34.408958	-119.872241	9/8/2017 12:29	34.405605	-119.872316
040_1230.RAW	9/8/2017 12:30	34.405481	-119.874712	9/8/2017 12:32	34.408167	-119.874977
042_1240.RAW	9/8/2017 12:40	34.404259	-119.884727	9/8/2017 12:42	34.405502	-119.883114
042_1243.RAW	9/8/2017 12:43	34.406591	-119.88187	9/8/2017 12:44	34.407271	-119.881166
043_1246.RAW	9/8/2017 12:46	34.409259	-119.882056	9/8/2017 12:49	34.406287	-119.887299
045_1251.RAW	9/8/2017 12:51	34.409156	-119.889788	9/8/2017 12:54	34.412279	-119.884445
047_1256.RAW	9/8/2017 12:56	34.415146	-119.886665	9/8/2017 13:00	34.411401	-119.892549

049_1301.RAW	9/8/2017 13:01	34.412884	-119.894716	9/8/2017 13:04	34.417968	-119.889662
051_1306.RAW	9/8/2017 13:06	34.419365	-119.892991	9/8/2017 13:11	34.413635	-119.895509
053_1312.RAW	9/8/2017 13:12	34.414385	-119.898528	9/8/2017 13:16	34.4202	-119.897314
055_1318.RAW	9/8/2017 13:18	34.421218	-119.901508	9/8/2017 13:23	34.416735	-119.904313
081_1329.RAW	9/8/2017 13:29	34.423072	-119.918397	9/8/2017 13:34	34.428368	-119.912765

Table 2. As-surveyed line endpoints, Goleta, Green PWC

	Start			End		
Line	Date/time (PST)	Lat	Lon	Date/time (PST)	Lat	Lon
051_0914.RAW	9/8/2017 9:14	34.393932	-119.746647	9/8/2017 9:14	34.394155	-119.746493
051_0924.RAW	9/8/2017 9:24	34.39347	-119.746817	9/8/2017 9:31	34.4023	-119.743876
003_0948.RAW	9/8/2017 9:48	34.408396	-119.819981	9/8/2017 9:54	34.416872	-119.819813
005_0957.RAW	9/8/2017 9:57	34.416458	-119.823654	9/8/2017 10:02	34.408195	-119.823631
075_1008.RAW	9/8/2017 10:08	34.402742	-119.825116	9/8/2017 10:17	34.416668	-119.824995
007_1023.RAW	9/8/2017 10:23	34.416631	-119.826304	9/8/2017 10:28	34.409796	-119.826609
009_1031.RAW	9/8/2017 10:31	34.410637	-119.829104	9/8/2017 10:35	34.416548	-119.829565
076_1036.RAW	9/8/2017 10:36	34.416517	-119.829964	9/8/2017 10:42	34.409978	-119.829469
011_1043.RAW	9/8/2017 10:43	34.409496	-119.830901	9/8/2017 10:48	34.416591	-119.831501
013_1049.RAW	9/8/2017 10:49	34.41604	-119.83363	9/8/2017 10:54	34.409526	-119.832435
015_1055.RAW	9/8/2017 10:55	34.409127	-119.833602	9/8/2017 10:59	34.415484	-119.835648
017_1101.RAW	9/8/2017 11:01	34.414186	-119.837927	9/8/2017 11:05	34.408829	-119.83458
019_1107.RAW	9/8/2017 11:07	34.408251	-119.834859	9/8/2017 11:11	34.411676	-119.840946
021_1114.RAW	9/8/2017 11:14	34.408743	-119.8414	9/8/2017 11:19	34.406113	-119.833845
023_1122.RAW	9/8/2017 11:22	34.403169	-119.835413	9/8/2017 11:26	34.404833	-119.843326
025_1128.RAW	9/8/2017 11:28	34.404071	-119.845654	9/8/2017 11:32	34.399672	-119.848801
027_1136.RAW	9/8/2017 11:36	34.399811	-119.853372	9/8/2017 11:41	34.4064	-119.849279
029_1152.RAW	9/8/2017 11:52	34.40698	-119.853346	9/8/2017 11:58	34.40065	-119.85672
032_1201.RAW	9/8/2017 12:01	34.400558	-119.860539	9/8/2017 12:03	34.402605	-119.86018
033_1205.RAW	9/8/2017 12:05	34.400795	-119.86202	9/8/2017 12:07	34.402192	-119.861728
080_1210.RAW	9/8/2017 12:10	34.400624	-119.862433	9/8/2017 12:11	34.402403	-119.862497
034_1213.RAW	9/8/2017 12:13	34.400946	-119.864099	9/8/2017 12:14	34.402469	-119.863828
035_1215.RAW	9/8/2017 12:15	34.401766	-119.866216	9/8/2017 12:16	34.402729	-119.865904
036_1218.RAW	9/8/2017 12:18	34.402095	-119.86837	9/8/2017 12:19	34.403322	-119.868472
037_1222.RAW	9/8/2017 12:22	34.402767	-119.870636	9/8/2017 12:23	34.404255	-119.870586
038_1225.RAW	9/8/2017 12:25	34.401554	-119.871817	9/8/2017 12:26	34.404192	-119.872186
039_1232.RAW	9/8/2017 12:32	34.402278	-119.872757	9/8/2017 12:33	34.403911	-119.873134
040_1235.RAW	9/8/2017 12:35	34.402238	-119.872643	9/8/2017 12:37	34.403696	-119.87398
044_1251.RAW	9/8/2017 12:51	34.410025	-119.883425	9/8/2017 12:56	34.407558	-119.888706
046_1257.RAW	9/8/2017 12:57	34.409575	-119.892443	9/8/2017 13:02	34.413463	-119.885657
048_1304.RAW	9/8/2017 13:04	34.415962	-119.888483	9/8/2017 13:09	34.412105	-119.893836
050_1310.RAW	9/8/2017 13:10	34.412845	-119.895251	9/8/2017 13:15	34.418899	-119.891527
052_1317.RAW	9/8/2017 13:17	34.419332	-119.894553	9/8/2017 13:22	34.41421	-119.896345
054_1324.RAW	9/8/2017 13:24	34.414994	-119.9003	9/8/2017 13:28	34.417311	-119.899977
056_1332.RAW	9/8/2017 13:32	34.421198	-119.903465	9/8/2017 13:36	34.417124	-119.907186

Table 3. As-surveyed line endpoints, Carpinteria, Black PWC

	Start			End		
Line	Date/time (PST)	Lat	Lon	Date/time (PST)	Lat	Lon
048_0934.RAW	9/7/2017 9:34	34.405175	-119.650738	9/7/2017 9:42	34.417099	-119.647275
046_0955.RAW	9/7/2017 9:55	34.403937	-119.599842	9/7/2017 10:04	34.418186	-119.594852
036_1007.RAW	9/7/2017 10:07	34.413691	-119.570732	9/7/2017 10:13	34.404914	-119.570471
035_1016.RAW	9/7/2017 10:16	34.405837	-119.564805	9/7/2017 10:21	34.413217	-119.559954
032_1024.RAW	9/7/2017 10:24	34.40115	-119.54328	9/7/2017 10:30	34.395355	-119.550722
030_1040.RAW	9/7/2017 10:40	34.393939	-119.549269	9/7/2017 10:44	34.399853	-119.541569
028_1045.RAW	9/7/2017 10:45	34.398614	-119.540249	9/7/2017 10:50	34.392973	-119.547937
026_1100.RAW	9/7/2017 11:00	34.396155	-119.537096	9/7/2017 11:04	34.392122	-119.539077
024_1108.RAW	9/7/2017 11:08	34.391311	-119.535256	9/7/2017 11:11	34.395986	-119.535426
022_1112.RAW	9/7/2017 11:12	34.395379	-119.53163	9/7/2017 11:18	34.387272	-119.534619
024_1118.RAW	9/7/2017 11:18	34.387274	-119.535428	9/7/2017 11:20	34.389919	-119.535455
020_1121.RAW	9/7/2017 11:21	34.386936	-119.533614	9/7/2017 11:26	34.394767	-119.529289
018_1127.RAW	9/7/2017 11:27	34.394467	-119.528558	9/7/2017 11:32	34.386847	-119.53268
016_1146.RAW	9/7/2017 11:46	34.386752	-119.53236	9/7/2017 11:51	34.394157	-119.527436
014_1152.RAW	9/7/2017 11:52	34.393793	-119.526739	9/7/2017 11:57	34.386605	-119.531909
012_1157.RAW	9/7/2017 11:57	34.3862	-119.531474	9/7/2017 12:02	34.393283	-119.525633
010_1203.RAW	9/7/2017 12:03	34.392665	-119.524769	9/7/2017 12:06	34.387916	-119.529114
008_1210.RAW	9/7/2017 12:09	34.386384	-119.526412	9/7/2017 12:13	34.391096	-119.522066
006_1215.RAW	9/7/2017 12:15	34.388835	-119.519095	9/7/2017 12:17	34.385525	-119.521228
004_1220.RAW	9/7/2017 12:20	34.381136	-119.50947	9/7/2017 12:20	34.381808	-119.509302
004_1222.RAW	9/7/2017 12:22	34.381418	-119.509597	9/7/2017 12:25	34.385486	-119.50818
002_1228.RAW	9/7/2017 12:28	34.381119	-119.487776	9/7/2017 12:34	34.373021	-119.491195
034_1247.RAW	9/7/2017 12:47	34.367731	-119.467522	9/7/2017 12:52	34.375494	-119.472409
032_1254.RAW	9/7/2017 12:54	34.374357	-119.462421	9/7/2017 12:59	34.365899	-119.464648
030_1300.RAW	9/7/2017 13:00	34.362738	-119.461598	9/7/2017 13:05	34.368388	-119.454601
028_1308.RAW	9/7/2017 13:08	34.361493	-119.448693	9/7/2017 13:13	34.35638	-119.455818
040_1315.RAW	9/7/2017 13:15	34.35394	-119.463756	9/7/2017 13:23	34.361391	-119.448521
026_1326.RAW	9/7/2017 13:26	34.355667	-119.438909	9/7/2017 13:33	34.347032	-119.437628
024_1334.RAW	9/7/2017 13:34	34.347086	-119.436403	9/7/2017 13:39	34.353087	-119.429874
039_1341.RAW	9/7/2017 13:41	34.350643	-119.426865	9/7/2017 13:49	34.343953	-119.44018
036_1407.RAW	9/7/2017 14:07	34.293896	-119.364622	9/7/2017 14:16	34.305445	-119.351596

Table 4. As-surveyed line endpoints, Carpinteria, Green PWC

	Start			End		
Line	Date/time (PST)	Lat	Lon	Date/time (PST)	Lat	Lon
049_0907.RAW	9/7/2017 9:07	34.400848	-119.675876	9/7/2017 9:16	34.41452	-119.67905
048_0930.RAW	9/7/2017 9:30	34.404974	-119.650757	9/7/2017 9:38	34.417161	-119.64734
047_0942.RAW	9/7/2017 9:42	34.406986	-119.630343	9/7/2017 9:50	34.418983	-119.628644
045_0959.RAW	9/7/2017 9:59	34.395533	-119.562935	9/7/2017 10:00	34.395551	-119.563088
045_1000.RAW	9/7/2017 10:00	34.395531	-119.562904	9/7/2017 10:10	34.408793	-119.553203
034_1012.RAW	9/7/2017 10:12	34.407689	-119.551933	9/7/2017 10:17	34.401363	-119.558385
033_1022.RAW	9/7/2017 10:22	34.395983	-119.551604	9/7/2017 10:27	34.40172	-119.544051
031_1029.RAW	9/7/2017 10:29	34.400318	-119.542524	9/7/2017 10:35	34.394634	-119.550054
029_1038.RAW	9/7/2017 10:38	34.393183	-119.548763	9/7/2017 10:44	34.399197	-119.540847
027_1045.RAW	9/7/2017 10:45	34.397172	-119.538908	9/7/2017 10:52	34.391603	-119.546566
025_1054.RAW	9/7/2017 10:54	34.386871	-119.535978	9/7/2017 11:00	34.395986	-119.536554
023_1102.RAW	9/7/2017 11:02	34.395766	-119.533515	9/7/2017 11:08	34.387087	-119.534895
044_1110.RAW	9/7/2017 11:10	34.385167	-119.539597	9/7/2017 11:18	34.394798	-119.529501
019_1121.RAW	9/7/2017 11:21	34.386785	-119.533163	9/7/2017 11:26	34.394639	-119.528886
017_1128.RAW	9/7/2017 11:28	34.394316	-119.528011	9/7/2017 11:33	34.386697	-119.532501
015_1134.RAW	9/7/2017 11:34	34.386434	-119.532272	9/7/2017 11:40	34.393964	-119.527058
013_1140.RAW	9/7/2017 11:40	34.393414	-119.526096	9/7/2017 11:46	34.386291	-119.531551
043_1150.RAW	9/7/2017 11:50	34.382677	-119.536322	9/7/2017 11:51	34.383593	-119.535384
043_1154.RAW	9/7/2017 11:54	34.382793	-119.536153	9/7/2017 12:02	34.393048	-119.525497
011_1203.RAW	9/7/2017 12:03	34.393023	-119.52525	9/7/2017 12:08	34.387931	-119.529425
009_1208.RAW	9/7/2017 12:08	34.387167	-119.528467	9/7/2017 12:12	34.392261	-119.523923
007_1214.RAW	9/7/2017 12:14	34.389822	-119.520712	9/7/2017 12:19	34.385267	-119.525126
005_1221.RAW	9/7/2017 12:21	34.382938	-119.514358	9/7/2017 12:25	34.387146	-119.513413
003_1229.RAW	9/7/2017 12:29	34.376168	-119.498866	9/7/2017 12:34	34.384747	-119.497397
001_1238.RAW	9/7/2017 12:38	34.372145	-119.490126	9/7/2017 12:43	34.374913	-119.480459
035_1248.RAW	9/7/2017 12:48	34.364477	-119.472965	9/7/2017 12:52	34.372782	-119.476682
033_1255.RAW	9/7/2017 12:55	34.36651	-119.469585	9/7/2017 13:00	34.375438	-119.467447
031_1304.RAW	9/7/2017 13:04	34.371362	-119.458841	9/7/2017 13:09	34.365453	-119.464715
029_1313.RAW	9/7/2017 13:12	34.360049	-119.459296	9/7/2017 13:17	34.364599	-119.451645
027_1320.RAW	9/7/2017 13:20	34.357619	-119.445387	9/7/2017 13:21	34.357562	-119.445327
025_1321.RAW	9/7/2017 13:21	34.357573	-119.44533	9/7/2017 13:21	34.357629	-119.445477
027_1322.RAW	9/7/2017 13:21	34.357574	-119.445323	9/7/2017 13:26	34.35282	-119.4528
025_1331.RAW	9/7/2017 13:31	34.346789	-119.43459	9/7/2017 13:36	34.355156	-119.433956
023_1339.RAW	9/7/2017 13:39	34.350029	-119.426436	9/7/2017 13:44	34.3447	-119.433916
022_1348.RAW	9/7/2017 13:48	34.340963	-119.430578	9/7/2017 13:53	34.345874	-119.423276
004_1406.RAW	9/7/2017 14:06	34.297201	-119.355582	9/7/2017 14:11	34.302339	-119.348581
003_1415.RAW	9/7/2017 14:15	34.298828	-119.344966	9/7/2017 14:19	34.29455	-119.352458

Table 5. As-surveyed line endpoints, Rincon, Black PWC

	Start			End		
Line	Date/time (PST)	Lat	Lon	Date/time (PST)	Lat	Lon
040_0924.RAW	9/6/2017 9:24	34.270555	-119.301187	9/6/2017 9:32	34.275923	-119.314266
011_1150.RAW	9/6/2017 11:50	34.312445	-119.373905	9/6/2017 11:56	34.320146	-119.377071
037_1159.RAW	9/6/2017 11:59	34.319503	-119.379285	9/6/2017 12:00	34.319106	-119.379516
037_1200.RAW	9/6/2017 12:00	34.319717	-119.379477	9/6/2017 12:10	34.30353	-119.375742
013_1217.RAW	9/6/2017 12:17	34.309233	-119.386284	9/6/2017 12:17	34.309504	-119.386233
013_1218.RAW	9/6/2017 12:18	34.309122	-119.386289	9/6/2017 12:18	34.309513	-119.386532
013_1219.RAW	9/6/2017 12:19	34.309353	-119.386216	9/6/2017 12:24	34.31741	-119.387707
015_1237.RAW	9/6/2017 12:37	34.319502	-119.404343	9/6/2017 12:42	34.323965	-119.395956
017_1247.RAW	9/6/2017 12:47	34.32521	-119.409392	9/6/2017 12:53	34.331305	-119.402494
019_1258.RAW	9/6/2017 12:58	34.336666	-119.410618	9/6/2017 13:05	34.32919	-119.415827
021_1310.RAW	9/6/2017 13:10	34.337318	-119.426659	9/6/2017 13:16	34.34268	-119.419077
051_1406.RAW	9/6/2017 14:06	34.236082	-119.279764	9/6/2017 14:14	34.222745	-119.275303

Table 6. As-surveyed line endpoints, Rincon, Green PWC

	Start			End		
Line	Date/time (PST)	Lat	Lon	Date/time (PST)	Lat	Lon
040_0925.RAW	9/6/2017 9:25	34.270447	-119.301061	9/6/2017 9:32	34.27593	-119.314251
001_1004.RAW	9/6/2017 10:04	34.29041	-119.339229	9/6/2017 10:10	34.285383	-119.346273
002_1014.RAW	9/6/2017 10:14	34.290444	-119.349969	9/6/2017 10:19	34.29502	-119.3424
003_1022.RAW	9/6/2017 10:22	34.298613	-119.345489	9/6/2017 10:29	34.29384	-119.353634
004_1035.RAW	9/6/2017 10:35	34.301808	-119.348346	9/6/2017 10:42	34.296076	-119.357061
005_1049.RAW	9/6/2017 10:49	34.30523	-119.351901	9/6/2017 10:54	34.299367	-119.358329
006_1100.RAW	9/6/2017 11:00	34.307948	-119.355882	9/6/2017 11:06	34.301739	-119.36143
007_1112.RAW	9/6/2017 11:12	34.310343	-119.360616	9/6/2017 11:14	34.310523	-119.361019
007_1114.RAW	9/6/2017 11:14	34.310427	-119.361092	9/6/2017 11:16	34.30878	-119.362402
008_1120.RAW	9/6/2017 11:20	34.313821	-119.364181	9/6/2017 11:28	34.308004	-119.370682
009_1138.RAW	9/6/2017 11:38	34.317267	-119.368148	9/6/2017 11:41	34.315772	-119.369567
010_1144.RAW	9/6/2017 11:44	34.319423	-119.372057	9/6/2017 11:50	34.31224	-119.375506
012_1201.RAW	9/6/2017 12:01	34.318976	-119.382055	9/6/2017 12:07	34.310802	-119.380231
014_1216.RAW	9/6/2017 12:16	34.319968	-119.393285	9/6/2017 12:21	34.315202	-119.40083
016_1229.RAW	9/6/2017 12:29	34.327383	-119.399425	9/6/2017 12:34	34.323298	-119.407216
018_1239.RAW	9/6/2017 12:39	34.333746	-119.406426	9/6/2017 12:45	34.327537	-119.412625
038_1251.RAW	9/6/2017 12:51	34.33646	-119.410691	9/6/2017 13:00	34.326194	-119.420987
020_1308.RAW	9/6/2017 13:08	34.339147	-119.414814	9/6/2017 13:13	34.33351	-119.421903
022_1321.RAW	9/6/2017 13:21	34.340916	-119.430541	9/6/2017 13:27	34.346304	-119.423316
050_1405.RAW	9/6/2017 14:05	34.236384	-119.27773	9/6/2017 14:13	34.223098	-119.273231

Table 7. As-surveyed line endpoints, Ventura, Black PWC

	Start			End		
Line	Date/time (PST)	Lat	Lon	Date/time (PST)	Lat	Lon
059_0855.RAW	9/5/2017 8:55	34.187164	-119.244288	9/5/2017 9:01	34.182923	-119.255451
060_0918.RAW	9/5/2017 9:18	34.192619	-119.261712	9/5/2017 9:24	34.197112	-119.249524
001_0926.RAW	9/5/2017 9:26	34.197152	-119.249471	9/5/2017 9:30	34.194261	-119.258021
061_0934.RAW	9/5/2017 9:34	34.200946	-119.271747	9/5/2017 9:42	34.207133	-119.254664
003_0945.RAW	9/5/2017 9:45	34.213489	-119.258389	9/5/2017 9:51	34.209555	-119.270818
005_0953.RAW	9/5/2017 9:53	34.218669	-119.2749	9/5/2017 10:00	34.222476	-119.262038
062_1002.RAW	9/5/2017 10:02	34.225129	-119.263302	9/5/2017 10:09	34.219927	-119.278331
063_1010.RAW	9/5/2017 10:10	34.221361	-119.27888	9/5/2017 10:18	34.230662	-119.264865
064_1018.RAW	9/5/2017 10:18	34.230745	-119.264877	9/5/2017 10:27	34.225002	-119.2811
065_1028.RAW	9/5/2017 10:28	34.228807	-119.282695	9/5/2017 10:36	34.231043	-119.265076
066_1037.RAW	9/5/2017 10:37	34.231039	-119.265098	9/5/2017 10:45	34.232849	-119.282607
011_1046.RAW	9/5/2017 10:46	34.234713	-119.281818	9/5/2017 10:53	34.235817	-119.266602
013_1055.RAW	9/5/2017 10:55	34.23913	-119.267518	9/5/2017 11:02	34.238518	-119.282209
015_1103.RAW	9/5/2017 11:03	34.243154	-119.283502	9/5/2017 11:11	34.244872	-119.267961
068_1115.RAW	9/5/2017 11:15	34.25376	-119.270152	9/5/2017 11:22	34.24821	-119.285079
017_1125.RAW	9/5/2017 11:25	34.253681	-119.28188	9/5/2017 11:29	34.256005	-119.271659
019_1132.RAW	9/5/2017 11:32	34.264018	-119.276889	9/5/2017 11:37	34.260401	-119.285326
069_1140.RAW	9/5/2017 11:40	34.256979	-119.292044	9/5/2017 11:41	34.259713	-119.2895
069_1143.RAW	9/5/2017 11:43	34.256908	-119.292081	9/5/2017 11:51	34.268735	-119.281146
021_1153.RAW	9/5/2017 11:53	34.270088	-119.283002	9/5/2017 11:57	34.264202	-119.288881
023_1200.RAW	9/5/2017 12:00	34.267532	-119.296703	9/5/2017 12:05	34.274985	-119.291998
025_1209.RAW	9/5/2017 12:09	34.273271	-119.29822	9/5/2017 12:13	34.265799	-119.296512
070_1219.RAW	9/5/2017 12:19	34.258998	-119.29803	9/5/2017 12:27	34.273257	-119.299008
027_1229.RAW	9/5/2017 12:29	34.272649	-119.30284	9/5/2017 12:34	34.264869	-119.302257
029_1237.RAW	9/5/2017 12:37	34.265053	-119.309741	9/5/2017 12:43	34.273149	-119.306358
031_1244.RAW	9/5/2017 12:44	34.273796	-119.308528	9/5/2017 12:49	34.266127	-119.312129
033_1250.RAW	9/5/2017 12:50	34.267712	-119.315472	9/5/2017 12:55	34.274662	-119.310607
035_1256.RAW	9/5/2017 12:56	34.27708	-119.314224	9/5/2017 13:00	34.27666	-119.316182
037_1307.RAW	9/5/2017 13:07	34.283393	-119.321823	9/5/2017 13:12	34.27581	-119.326088
035_1315.RAW	9/5/2017 13:15	34.270857	-119.320968	9/5/2017 13:20	34.277147	-119.314487
039_1325.RAW	9/5/2017 13:25	34.287108	-119.331632	9/5/2017 13:26	34.287238	-119.331936
071_1327.RAW	9/5/2017 13:27	34.28618	-119.329273	9/5/2017 13:36	34.273119	-119.337147
041_1345.RAW	9/5/2017 13:45	34.275265	-119.314889	9/5/2017 13:52	34.26973	-119.301701
043_1353.RAW	9/5/2017 13:53	34.268016	-119.302422	9/5/2017 13:59	34.273284	-119.315145
045_1400.RAW	9/5/2017 14:00	34.271781	-119.316248	9/5/2017 14:06	34.266478	-119.303619
046_1416.RAW	9/5/2017 14:16	34.239452	-119.269693	9/5/2017 14:24	34.225141	-119.264854
048_1425.RAW	9/5/2017 14:25	34.223983	-119.268975	9/5/2017 14:34	34.237362	-119.273457

Table 8. As-surveyed line endpoints, Ventura, Green PWC

	Start			End		
Line	Date/time (PST)	Lat	Lon	Date/time (PST)	Lat	Lon
058_0853.RAW	9/5/2017 8:53	34.173261	-119.252313	9/5/2017 9:01	34.178023	-119.239739
057_0901.RAW	9/5/2017 9:01	34.178037	-119.239703	9/5/2017 9:01	34.178047	-119.239682
001_0920.RAW	9/5/2017 9:20	34.193945	-119.258888	9/5/2017 9:25	34.197235	-119.249871
002_0930.RAW	9/5/2017 9:30	34.205658	-119.254094	9/5/2017 9:30	34.205845	-119.254079
002_0932.RAW	9/5/2017 9:32	34.205501	-119.254253	9/5/2017 9:37	34.202701	-119.262407
004_0944.RAW	9/5/2017 9:44	34.214014	-119.272858	9/5/2017 9:51	34.217958	-119.260571
006_0956.RAW	9/5/2017 9:56	34.2268	-119.263915	9/5/2017 10:04	34.222984	-119.276663
008_1009.RAW	9/5/2017 10:09	34.227339	-119.278861	9/5/2017 10:16	34.23041	-119.265083
007_1019.RAW	9/5/2017 10:19	34.228399	-119.264495	9/5/2017 10:26	34.224787	-119.277379
009_1030.RAW	9/5/2017 10:30	34.229842	-119.280518	9/5/2017 10:38	34.23227	-119.26577
010_1040.RAW	9/5/2017 10:40	34.234077	-119.266403	9/5/2017 10:48	34.232585	-119.280829
012_1051.RAW	9/5/2017 10:51	34.236657	-119.281822	9/5/2017 10:59	34.237606	-119.267429
014_1101.RAW	9/5/2017 11:01	34.241419	-119.268538	9/5/2017 11:10	34.240465	-119.284097
016_1115.RAW	9/5/2017 11:15	34.25029	-119.28121	9/5/2017 11:21	34.251977	-119.269581
018_1127.RAW	9/5/2017 11:27	34.256382	-119.283874	9/5/2017 11:33	34.259923	-119.273941
020_1137.RAW	9/5/2017 11:36	34.266955	-119.279751	9/5/2017 11:42	34.262011	-119.287058
022_1145.RAW	9/5/2017 11:45	34.26557	-119.293053	9/5/2017 11:51	34.27278	-119.287313
024_1157.RAW	9/5/2017 11:57	34.265622	-119.292623	9/5/2017 12:03	34.273676	-119.296086
026_1206.RAW	9/5/2017 12:06	34.272842	-119.300359	9/5/2017 12:11	34.264839	-119.299967
028_1215.RAW	9/5/2017 12:15	34.264428	-119.306685	9/5/2017 12:21	34.272223	-119.305364
030_1224.RAW	9/5/2017 12:24	34.265613	-119.311248	9/5/2017 12:30	34.273282	-119.307765
032_1242.RAW	9/5/2017 12:42	34.266072	-119.313584	9/5/2017 12:49	34.274097	-119.309719
034_1251.RAW	9/5/2017 12:51	34.275869	-119.312731	9/5/2017 12:57	34.269341	-119.318397
036_1301.RAW	9/5/2017 13:01	34.274086	-119.325306	9/5/2017 13:07	34.280466	-119.318251
038_1312.RAW	9/5/2017 13:12	34.285262	-119.326926	9/5/2017 13:18	34.277627	-119.330868
039_1324.RAW	9/5/2017 13:24	34.279512	-119.336572	9/5/2017 13:30	34.287241	-119.332012
042_1346.RAW	9/5/2017 13:46	34.274233	-119.314869	9/5/2017 13:52	34.268854	-119.302048
044_1353.RAW	9/5/2017 13:53	34.267294	-119.30317	9/5/2017 14:00	34.272608	-119.315801
047_1416.RAW	9/5/2017 14:15	34.238241	-119.271457	9/5/2017 14:16	34.237808	-119.271282
047_1417.RAW	9/5/2017 14:17	34.238287	-119.271489	9/5/2017 14:26	34.224653	-119.26694
049_1429.RAW	9/5/2017 14:29	34.223381	-119.271059	9/5/2017 14:38	34.236909	-119.275567

Table 9. As-surveyed line endpoints, Mugu, Black PWC

	Start			End		
Line	Date/time (PST)	Lat	Lon	Date/time (PST)	Lat	Lon
057_0908.RAW	9/9/2017 9:08	34.15116	-119.219847	9/9/2017 9:15	34.144867	-119.232185
056_0920.RAW	9/9/2017 9:20	34.129174	-119.206375	9/9/2017 9:28	34.141928	-119.196959
056_0928.RAW	9/9/2017 9:28	34.141937	-119.196955	9/9/2017 9:28	34.14195	-119.196948
054_0934.RAW	9/9/2017 9:34	34.119102	-119.160497	9/9/2017 9:42	34.108717	-119.171385
072_0952.RAW	9/9/2017 9:52	34.09019	-119.089706	9/9/2017 9:58	34.098325	-119.084392
073_1001.RAW	9/9/2017 10:01	34.099461	-119.090495	9/9/2017 10:05	34.095482	-119.092853
074_1007.RAW	9/9/2017 10:07	34.091632	-119.095912	9/9/2017 10:12	34.099452	-119.09543
075_1014.RAW	9/9/2017 10:14	34.099142	-119.100121	9/9/2017 10:18	34.093845	-119.09735
076_1019.RAW	9/9/2017 10:19	34.093332	-119.0987	9/9/2017 10:22	34.09764	-119.102428
077_1024.RAW	9/9/2017 10:24	34.095477	-119.106797	9/9/2017 10:29	34.085507	-119.10572

Table 10. As-surveyed line endpoints, Mugu, Green PWC

	Start			End		
Line	Date/time (PST)	Lat	Lon	Date/time (PST)	Lat	Lon
057_0908.RAW	9/9/2017 9:08	34.151255	-119.219959	9/9/2017 9:15	34.144831	-119.232091
055_0925.RAW	9/9/2017 9:25	34.127971	-119.199807	9/9/2017 9:33	34.13932	-119.19142
053_0953.RAW	9/9/2017 9:53	34.081127	-119.07166	9/9/2017 9:58	34.088001	-119.065129
078_1010.RAW	9/9/2017 10:10	34.095396	-119.083981	9/9/2017 10:17	34.099473	-119.096191
079_1020.RAW	9/9/2017 10:20	34.098859	-119.086331	9/9/2017 10:28	34.098388	-119.101329
080_1029.RAW	9/9/2017 10:29	34.099535	-119.097547	9/9/2017 10:37	34.093555	-119.108183

Appendix A: Weather Observation Forms

Date: 9/5/17 _____ **Monitor:** __Jessica Lovering_____

Time	Latitude	Longitude	Vessel Activity	Weather	Cloud Cover	Glare	Visibility	Wind Speed	Sea State	Swell Height	Comments
0830 – 1430 PDT	34.17326 to 34.28724	-119.33715 to -119.2397	surveying	overcast	90-100	none	5 km	7-10 kts	Slight chop	1m	

Date: 9/6/17 _____ **Monitor:** __Dan Hoover_____

Time	Latitude	Longitude	Vessel Activity	Weather	Cloud Cover	Glare	Visibility	Wind Speed	Sea State	Swell Height	Comments
0900 – 1415 PDT	34.22274 to 34.34630	-119.43054 to -119.27323	surveying	overcast	90-100	none	10 km	10-20 kts	Choppy	1m	

Date: 9/7/17 _____ **Monitor:** __Amy Foxgrover_____

Time	Latitude	Longitude	Vessel Activity	Weather	Cloud Cover	Glare	Visibility	Wind Speed	Sea State	Swell Height	Comments
0900 – 1415 PDT	34.29390 to 34.41898	-119.6790 to -119.3450	surveying	clear	Clear	mild	10 km	1-3 kts	Rippled	0.5m	

Date: 9/8/17 _____ **Monitor:** __ Amy Foxgrover _____

Time	Latitude	Longitude	Vessel Activity	Weather	Cloud Cover	Glare	Visibility	Wind Speed	Sea State	Swell Height	Comments
0900 – 1330 PDT	34.38992 to 34.42837	-119.9184 to -119.6898	surveying	clear	Clear	mild	10 km	4-6 kts	Slight chop	0.5m	

Date: 9/9/17 _____ **Monitor:** __Amy Foxgrover_____

Time	Latitude	Longitude	Vessel Activity	Weather	Cloud Cover	Glare	Visibility	Wind Speed	Sea State	Swell Height	Comments
0900 - 1200 PDT	34.08113 to 34.15126	-119.2322 to -119.0651	surveying	clear	Clear	none	10 km	1-3 kts	Rippled	0.5m	

Appendix B: Marine Wildlife Observations

Date: 9/5-9/17 _____ Monitor: Various (see weather logs)

Sea lions occasionally were noted resting at the surface, and sea otters occasionally were seen from a distance, resting in kelp, but infrequently and not in great abundance. Dolphins were observed off of Ellwood Beach in Goleta on 9/8/17 (~34.41 N, -119.89 E, ~12:51 PM), but there were no observations of unusual behavior or of whales or unusual aggregations of seabirds.

Mitigation Measure (MM)	Location and Scope of Mitigation	Effectiveness Criteria	Monitoring or Reporting Action	Responsible Party	Timing	Implementation Date(s) and Initials
Air Quality and Greenhouse Gas (GHG) Emissions (MND Section 3.3.3)						
MM AIR-1: Engine Tuning, Engine Certification, and Fuels. The following measures will be required to be implemented by all Permittees under the Offshore Geophysical Permit Program (OGPP), as applicable depending on the county offshore which a survey is being conducted. Pursuant to section 93118.5 of CARB's Airborne Toxic Control Measures, the Tier 2 engine requirement applies only to diesel-fueled vessels.	All Counties: Maintain all construction equipment in proper tune according to manufacturers' specifications; fuel all off-road and portable diesel-powered equipment with California Air Resources Board (CARB)-certified motor vehicle diesel fuel limiting sulfur content to 15 parts per million or less (CARB Diesel).	Daily emissions of criteria pollutants during survey activities are minimized.	Determine engine certification of vessel engines. Review engine emissions data to assess compliance, determine if changes in tuning or fuel are required.	OGPP permit holder and contract vessel operator; California State Lands Commission (CSLC) review of Final Monitoring Report.	Prior to, during, and after survey activities. Submit Final Monitoring Report after completion of survey activities.	N/A
	Los Angeles and Orange Counties: Use vessel engines meeting CARB's Tier 2-certified engines or cleaner; the survey shall be operated such that daily NO_x emissions do not exceed 100 pounds based on engine certification emission factors. This can be accomplished with Tier 2 engines if daily fuel use is 585 gallons or less, and with Tier 3 engines if daily fuel use is 935 gallons or less.		Verify that Tier 2 or cleaner engines are being used. Calculate daily NO_x emissions to verify compliance with limitations.			
	San Luis Obispo County: Use vessel engines meeting CARB's Tier 2-certified engines or cleaner, accomplished with Tier 2 engines if daily fuel use is 585 gallons or less; all diesel equipment shall not idle for more than 5 minutes; engine use needed to maintain position in the water is not considered idling; diesel idling within 300 meters (1,000 feet) of sensitive receptors is not permitted; use alternatively fueled construction equipment on site where feasible, such as compressed natural gas, liquefied natural gas, propane or biodiesel.		Verify that Tier 2 or cleaner engines are being used. Inform vessel operator(s) of idling limitation. Investigate availability of alternative fuels.			
	Santa Barbara County: Use vessel engines meeting CARB's Tier 2-certified engines or cleaner, accomplished with Tier 2 engines if daily fuel use is 790 gallons or less.		Verify that Tier 2 or cleaner engines are being used. Investigate availability of alternative fuels.			
	Ventura County: Use alternatively fueled construction equipment on site where feasible, such as compressed natural gas, liquefied natural gas, propane or biodiesel.		Investigate availability of alternative fuels.			

Mitigation Measure (MM)	Location and Scope of Mitigation	Effectiveness Criteria	Monitoring or Reporting Action	Responsible Party	Timing	Implementation Date(s) and Initials
MM BIO-1: Marine Mammal and Sea Turtle Presence – Current Information.	All State waters; prior to commencement of survey operations, the geophysical operator shall: (1) contact the National Oceanic and Atmospheric Administration Long Beach office staff and local whale-watching operations and shall acquire information on the current composition and relative abundance of marine wildlife offshore, and (2) convey sightings data to the vessel operator and crew, survey party chief, and onboard Marine Wildlife Monitors (MWMs) prior to departure. This information will aid the MWMs by providing data on the approximate number and types of organisms that may be in the area.	No adverse effects to marine mammals or sea turtles due to survey activities are observed.	Document contact with appropriate sources. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder; Inquiry to NOAA and local whale watching operators.	Prior to survey.	8/2/17
MM BIO-2: Marine Wildlife Monitors (MWMs).	Except as provided in section 7(h) of the General Permit, a minimum of two (2) qualified MWMs who are experienced in marine wildlife observations shall be onboard the survey vessel throughout both transit and data collection activities. The specific monitoring, observation, and data collection responsibilities shall be identified in the Marine Wildlife Contingency Plan required as part of all Offshore Geophysical Permit Program permits. Qualifications of proposed MWMs shall be submitted to the National Oceanic and Atmospheric Administration (NOAA) and CSLC at least twenty-one (21) days in advance of the survey for their approval by the agencies. Survey operations shall not commence until the CSLC approves the MWMs.	Competent and professional monitoring or marine mammals and sea turtles; compliance with established monitoring policies.	Document contact with and approval by appropriate agencies. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Prior to survey.	8/2/17
MM BIO-3: Safety Zone Monitoring.	Onboard Marine Wildlife Monitors (MWMs) responsible for observations during vessel transit shall be responsible for monitoring during the survey equipment operations. All visual monitoring shall occur from the highest practical vantage point aboard the survey vessel; binoculars shall be used to observe the surrounding area, as appropriate. The MWMs will survey an area (i.e., safety or exclusion zone) based on the equipment used, centered on the sound source (i.e., vessel, towfish), throughout time that the survey equipment is operating. Safety zone radial distances, by equipment type, include:	No adverse effects to marine mammals or sea turtles due to survey activities are observed; compliance with established safety zones.	Compliance with permit requirements (observers); compliance with established safety zones. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Prior to survey.	8/2/17

Mitigation Measure (MM)	Location and Scope of Mitigation	Effectiveness Criteria	Monitoring or Reporting Action	Responsible Party	Timing	Implementation Date(s) and Initials

Equipment Type	Safety Zone (radius, m)
Single Beam Echosounder	50
Multibeam Echosounder	500
Side-Scan Sonar	600
Subbottom Profiler	100
Boomer System	100

If the geophysical survey equipment is operated at or above a frequency of 200 kilohertz (kHz), safety zone monitoring and enforcement is not required; however, if geophysical survey equipment operated at a frequency at or above 200 kHz is used simultaneously with geophysical survey equipment less than 200 kHz, then the safety zone for the equipment less than 200 kHz must be monitored. The onboard MWMs shall have authority to stop operations if a mammal or turtle is observed within the specified safety zone and may be negatively affected by survey activities. The MWMs shall also have authority to recommend continuation (or cessation) of operations during periods of limited visibility (i.e., fog, rain) based on the observed abundance of marine wildlife. Periodic reevaluation of weather conditions and reassessment of the continuation/cessation recommendation shall be completed by the onboard MWMs. During operations, if an animal's actions are observed to be irregular, the monitor shall have authority to recommend that equipment be shut down until the animal moves further away from the sound source. If irregular behavior is observed, the equipment shall be shut-off and will be restarted and ramped-up to full power, as applicable, or will not be started until the animal(s) is/are outside of the safety zone or have not been observed for 15 minutes.

For nearshore survey operations utilizing vessels that lack the personnel capacity to hold two (2) MWMs aboard during survey operations, at least twenty-one (21) days prior to the commencement of survey activities, the Permittee may petition the CSLC to conduct survey operations with one (1) MWM aboard. The CSLC will consider such authorization on a case-by-case basis and

8/2/17

Mitigation Measure (MM)	Location and Scope of Mitigation	Effectiveness Criteria	Monitoring or Reporting Action	Responsible Party	Timing	Implementation Date(s) and Initials
	factors the CSLC will consider will include the timing, type, and location of the survey, the size of the vessel, and the availability of alternate vessels for conducting the proposed survey. CSLC authorizations under this subsection will be limited to individual surveys and under any such authorization; the Permittee shall update the MWCP to reflect how survey operations will occur under the authorization.					
MM BIO-4: Limits on Nighttime OGPP Surveys.	All State waters; nighttime survey operations are prohibited under the OGPP, except as provided below. The CSLC will consider the use of single beam echosounders and passive equipment types at night on a case-by-case basis, taking into consideration the equipment specifications, location, timing, and duration of survey activity.	No adverse effects to marine mammals or sea turtles due to survey activities are observed.	Presurvey request for nighttime operations, including equipment specifications and proposed use schedule. Document equipment use. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Approval required before survey is initiated. Monitoring Report following comple-tion of survey.	8/2/17
MM BIO-5: Soft Start.	All State waters; the survey operator shall use a "soft start" technique at the beginning of survey activities each day (or following a shut down) to allow any marine mammal that may be in the immediate area to leave before the sound sources reach full energy. Surveys shall not commence at nighttime or when the safety zone cannot be effectively monitored. Operators shall initiate each piece of equipment at the lowest practical sound level, increasing output in such a manner as to increase in steps not exceeding approximately 6 decibels (dB) per 5-minute period. During ramp-up, the Marine Wildlife Monitors (MWMs) shall monitor the safety zone. If marine mammals are sighted within or about to enter the safety zone, a power-down or shut down shall be implemented as though the equipment was operating at full power. Initiation of ramp-up procedures from shut down requires that the MWMs be able to visually observe the full safety zone.	No adverse effects to marine mammals or sea turtles due to survey activities are observed.	Compliance with permit requirements (observers); compliance with safe start procedures. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Imme-diately prior to survey.	9/5/17

Mitigation Measure (MM)	Location and Scope of Mitigation	Effectiveness Criteria	Monitoring or Reporting Action	Responsible Party	Timing	Implementation Date(s) and Initials
MM BIO-6: Practical Limitations on Equipment Use and Adherence to Equipment Manufacturer's Routine Maintenance Schedule.	All State waters; geophysical operators shall follow, to the maximum extent possible, the guidelines of Zykov (2013) as they pertain to the use of subbottom profilers and side-scan sonar, including: • Using the highest frequency band possible for the subbottom profiler; • Using the shortest possible pulse length; and • Lowering the pulse rate (pings per second) as much as feasible. Geophysical operators shall consider the potential applicability of these measures to other equipment types (e.g., boomer). Permit holders will conduct routine inspection and maintenance of acoustic-generating equipment to ensure that low energy geophysical equipment used during permitted survey activities remains in proper working order and within manufacturer's equipment specifications. Verification of the date and occurrence of such equipment inspection and maintenance shall be provided in the required presurvey notification to CSLC.	No adverse effects to marine mammals or sea turtles due to survey activities are observed.	Document initial and during survey equipment settings. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Immediately prior to and during survey.	9/6/17
MM BIO-7: Avoidance of Pinniped Haul-Out Sites.	The Marine Wildlife Contingency Plan (MWCP) developed and implemented for each survey shall include identification of haul-out sites within or immediately adjacent to the proposed survey area. For surveys within 300 meters (m) of a haul-out site, the MWCP shall further require that: • The survey vessel shall not approach within 91 m of a haul-out site, consistent with National Marine Fisheries Service (NMFS) guidelines; • Survey activity close to haul-out sites shall be conducted in an expedited manner to minimize the potential for disturbance of pinnipeds on land; and • Marine Wildlife Monitors shall monitor pinniped activity onshore as the vessel approaches, observing and reporting on the number of pinnipeds potentially disturbed (e.g., via head lifting, flushing into the water). The purpose of such reporting is to provide CSLC and California Department of Fish and Wildlife (CDFW) with information regarding potential disturbance associated with OGPP surveys.	No adverse effects to pinnipeds at haul outs are observed.	Document pinniped reactions to vessel presence and equipment use. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Monitoring Report following completion of survey.	9/10/17

Mitigation Measure (MM)	Location and Scope of Mitigation	Effectiveness Criteria	Monitoring or Reporting Action	Responsible Party	Timing	Implementation Date(s) and Initials
MM BIO-8: Reporting Requirements – Collision.	All State waters; if a collision with marine mammal or reptile occurs, the vessel operator shall document the conditions under which the accident occurred, including the following: • Vessel location (latitude, longitude) when the collision occurred; • Date and time of collision; • Speed and heading of the vessel at the time of collision; • Observation conditions (e.g., wind speed and direction, swell height, visibility in miles or kilometers, and presence of rain or fog) at the time of collision; • Species of marine wildlife contacted (if known); • Whether an observer was monitoring marine wildlife at the time of collision; and, • Name of vessel, vessel owner/operator, and captain officer in charge of the vessel at time of collision. After a collision, the vessel shall stop, if safe to do so; however, the vessel is not obligated to stand by and may proceed after confirming that it will not further damage the animal by doing so. The vessel will then immediately communicate by radio or telephone all details to the vessel's base of operations, and shall immediately report the incident. Consistent with Marine Mammal Protection Act requirements, the vessel's base of operations or, if an onboard telephone is available, the vessel captain him/herself, will then immediately call the National Oceanic and Atmospheric Administration (NOAA) Stranding Coordinator to report the collision and follow any subsequent instructions. From the report, the Stranding Coordinator will coordinate subsequent action, including enlisting the aid of marine mammal rescue organizations, if appropriate. From the vessel's base of operations, a telephone call will be placed to the Stranding Coordinator, NOAA National Marine Fisheries Service (NMFS), Southwest Region, Long Beach, to obtain instructions. Although NOAA has primary responsibility for marine mammals in both State and Federal waters, the California Department of Fish and Wildlife (CDFW) will also be advised that an incident has occurred in State waters affecting a protected species.	No adverse effects to marine mammals or sea turtles due to survey activities are observed.	Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Monitoring Report following comple-tion of survey.	9/10/17

Mitigation Measure (MM)	Location and Scope of Mitigation	Effectiveness Criteria	Monitoring or Reporting Action	Responsible Party	Timing	Implementation Date(s) and Initials
MM BIO-9: Limitations on Survey Operations in Select Marine Protected Areas (MPAs).	All MPAs; prior to commencing survey activities, geophysical operators shall coordinate with the CLSC, California Department of Fish and Wildlife (CDFW), and any other appropriate permitting agency regarding proposed operations within MPAs. The scope and purpose of each survey proposed within a MPA shall be defined by the permit holder, and the applicability of the survey to the allowable MPA activities shall be delineated by the permit holder. If deemed necessary by CDFW, geophysical operators will pursue a scientific collecting permit, or other appropriate authorization, to secure approval to work within a MPA, and shall provide a copy of such authorization to the CSLC as part of the required presurvey notification to CSLC. CSLC, CDFW, and/or other permitting agencies may impose further restrictions on survey activities as conditions of approval.	No adverse effects to MPA resources due to survey activities are observed.	Monitor reactions of wildlife to survey operations; report on shutdown conditions and survey restart. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder; survey permitted by CDFW.	Prior to survey.	8/2/17
MM HAZ-1: Oil Spill Contingency Plan (OSCP) Required Information.	Permittees shall develop and submit to CSLC staff for review and approval an OSCP that addresses accidental releases of petroleum and/or non-petroleum products during survey operations. Permittees' OSCPs shall include the following information for each vessel to be involved with the survey: • Specific steps to be taken in the event of a spill, including notification names, phone numbers, and locations of: (1) nearby emergency medical facilities, and (2) wildlife rescue/response organizations (e.g., Oiled Wildlife Care Network); • Description of crew training and equipment testing procedures; and • Description, quantities, and location of spill response equipment onboard the vessel.	Reduction in the potential for an accidental spill. Proper and timely response and notification of responsible parties in the event of a spill.	Documentation of proper spill training. Notification of responsible parties in the event of a spill.	OGPP permit holder and contract vessel operator.	Prior to survey.	8/2/17
MM HAZ-2: Vessel fueling restrictions.	Vessel fueling shall only occur at an approved docking facility. No cross vessel fueling shall be allowed.	Reduction in the potential for an accidental spill.	Documentation of fueling activities.	Contract vessel operator.	Following survey.	9/9/17
MM HAZ-3: OSCP equipment and supplies.	Onboard spill response equipment and supplies shall be sufficient to contain and recover the worst-case scenario spill of petroleum products as outlined in the OSCP.	Proper and timely response in the event of a spill.	Notification to CSLC of onboard spill response equipment/supplies inventory, verify	Contract vessel operator.	Prior to survey.	8/2/17

Mitigation Measure (MM)	Location and Scope of Mitigation	Effectiveness Criteria	Monitoring or Reporting Action	Responsible Party	Timing	Implementation Date(s) and Initials
			ability to respond to worst-case spill.			
MM HAZ-1: Oil Spill Contingency Plan (OSCP) Required Information.	Outlined under **Hazards and Hazardous Materials** (above)					
MM HAZ-2: Vessel fueling restrictions.	Outlined under **Hazards and Hazardous Materials** (above)					
MM HAZ-3: OSCP equipment and supplies.	Outlined under **Hazards and Hazardous Materials** (above)					
MM BIO-9: Limitations on Survey Operations in Select MPAs.	Outlined under **Biological Resources** (above)					
MM REC-1: U.S. Coast Guard (USCG), Harbormaster, and Dive Shop Operator Notification.	All California waters where recreational diving may occur; as a survey permit condition, the CSLC shall require Permittees to provide the USCG with survey details, including information on vessel types, survey locations, times, contact information, and other details of activities that may pose a hazard to divers so that USCG can include the information in the Local Notice to Mariners, advising vessels to avoid potential hazards near survey areas. Furthermore, at least twenty-one (21) days in advance of in-water activities, Permittees shall: (1) post such notices in the harbormasters' offices of regional harbors; and (2) notify operators of dive shops in coastal locations adjacent to the proposed offshore survey operations.	No adverse effects to recreational divers from survey operations.	Notify the USCG, local harbormasters, and local dive shops of planned survey activity. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Prior to survey.	8/2/17

Mitigation Measure (MM)	Location and Scope of Mitigation	Effectiveness Criteria	Monitoring or Reporting Action	Responsible Party	Timing	Implementation Date(s) and Initials
MM FISH-1: U.S. Coast Guard (USCG) and Harbormaster Notification.	All California waters; as a survey permit condition, the CSLC shall require Permittees to provide the USCG with survey details, including information on vessel types, survey locations, times, contact information, and other details of activities that may pose a hazard to mariners and fishers so that USCG can include the information in the Local Notice to Mariners, advising vessels to avoid potential hazards near survey areas. Furthermore, at least twenty-one (21) days in advance of in-water activities, Permittees shall post such notices in the harbormasters' offices of regional harbors.	No adverse effects to commercial fishing gear in place.	Notify the USCG and local harbormasters of planned survey activity. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Prior to survey.	8/2/17
MM FISH-2: Minimize Interaction with Fishing Gear.	To minimize interaction with fishing gear that may be present within a survey area: (1) the geophysical vessel (or designated vessel) shall traverse the proposed survey corridor prior to commencing survey operations to note and record the presence, type, and location of deployed fishing gear (i.e., buoys); (2) no survey lines within 30 m (100 feet) of observed fishing gear shall be conducted. The survey crew shall not remove or relocate any fishing gear; removal or relocation shall only be accomplished by the owner of the gear upon notification by the survey operator of the potential conflict.	No adverse effects to commercial fishing gear in place.	Visually observe the survey area for commercial fishing gear. Notify the gear owner and request relocation of gear outside survey area. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Imme-diately prior to survey (prior to each survey day).	8/5/17
MM FISH-1: USCG and Harbormaster Notification.	Outlined under **Commercial and Recreational Fisheries** (above)					

Acronyms/Abbreviations: CARB = California Air Resources Board; CDFW = California Department of Fish and Wildlife; CSLC = California State Lands Commission; dB = decibels; kHz = kilohertz; MPA = Marine Protected Area; MWCP = Marine Wildlife Contingency Plan; MWM = Marine Wildlife Monitor; m= meter(s); NOAA = National Oceanic and Atmospheric Administration; NO_x = Nitrogen Oxide; OGPP = Offshore Geophysical Permit Program; OSCP = Oil Spill Contingency Plan; USCG = U.S. Coast Guard